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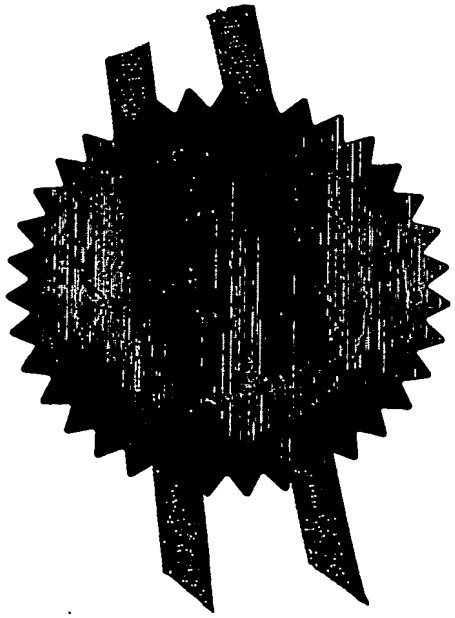

Signed

Dated 19 September 2003

Patents Form 1/77

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1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

= 5 APR 2003

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference — 85964/12921/05

07APR03 E798250-2 D00113
P01/7700 0.00-0307963.9

2. Patent application number *(The Patent office will fill in this part)* — 0307963.9

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

EASTMAN KODAK COMPANY
343 STATE STREET
ROCHESTER
NEW YORK 14650-2201
UNITED STATES OF AMERICA

Patents ADP number *(if you know it)* 04230200 01

If the applicant is a corporate body, give the country/state of its incorporation — NEW JERSEY

4. Title of the invention — A FOAMED MATERIAL AND A METHOD OF MAKING THEREOF

5. Name of your agent *(if you have one)* — A FREEMAN

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

KODAK LIMITED
PATENTS, W92-3A
HEADSTONE DRIVE
HARROW
MIDDLESEX HA1 4TY

Patents ADP number *(if you know it)* 07533110001

6. If you are declaring priority from one or more earlier patent applications, give the country and date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of Filing (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)

8. Is a statement of inventorship and of right to grant a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document.

Continuation sheets of this form	
Description	7
Claim(s)	2
Abstract	1
Drawing(s)	1 + (SVS)

10. If you are also filing any of the following, state how many against each item.

Priority Documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patent Form 9/77)*	
Request for substantive examination *(Patent Form 10/77)*	
Any other documents *(please specify)*	

11. **I/We request the grant of a patent on the basis of this application.**

Signature  **Date** 4 April 2003

12. Name and daytime telephone number of person to contact in the United Kingdom **A FREEMAN** **020 8424 4431**

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A FOAMED MATERIAL AND A METHOD OF MAKING THEREOF

FIELD OF THE INVENTION

The present invention relates to a method of making a foamed material. In particular the invention relates to a method of making a foamed material suitable for use as, amongst other things, an inkjet receiver. The invention also relates to a material made using the method.

BACKGROUND OF THE INVENTION

To be suitable for use as an inkjet receiver a material must preferably be quick to absorb applied ink and also once dry, printed images must preferably be stable when subjected to light and ozone. Inkjet media having a porous layer are typically formed of inorganic materials with a polymeric binder. When ink is applied to the medium it is absorbed quickly into the porous layer by capillary action. However, the open nature of the layer can contribute to a lack of stability of printed images when subjected to light and ozone. Inkjet media having a non-porous layer are typically formed by the coating of one or more polymeric layers onto a support. When ink is applied to such media, the polymeric layers swell and absorb the applied ink. However, due to limitations of the swelling mechanism, this type of media is slow to absorb the ink, but once dry, printed images are often stable when subjected to light and ozone.

Polymer foams have been developed that are suitable for use as inkjet receivers. The materials, as disclosed for example in our co-pending UK Patent Application Number 0218507.2, can be both quick to absorb applied ink and also provide images that are stable to light and ozone once dry.

Traditionally polymer foams are manufactured using mostly hydrophobic thermoplastic materials such as Polyurethane, PVC and Polyethylene. Initially a gas-filled polymer is created using a known foaming method, the gas-filled polymer then being coated onto a support substrate.

Typical foaming methods include:

1. Thermal decomposition of chemical blowing agents, generating N_2 or CO_2, by application of heat or as a result of the exothermic heat of reaction during polymerisation.

2. Mechanical whipping of gases into a polymer melt, which hardens either by catalytic action or heat, trapping gas bubbles in a matrix.

3. The use of low boiling point liquids which boil at low temperatures thereby creating gas.

4. Expansion of a gas dissolved in a polymer upon reduction of pressure in the system.

5. Incorporation of microspheres into a polymer mass, the microspheres consisting of gas filled polymer that expands upon heating.

After obtaining the gas filled polymer by one or more of the methods above, the material is then formed, typically, using one of three common manufacturing processes:

1. Compression moulding
2. Reaction injection moulding or
3. Extrusion of the foam.

The temperatures involved in these processes can be very high, e.g. in excess of 150°C, as the polymers used are in their molten state.
The most common processing method used in creating polymer foam films is extrusion. This is a three-stage operation consisting of forming a polymer solution with gas dissolved in it, by injection of N_2 or CO_2, or by the use of blowing agent, to create a single phase solution. Nucleation sites are then formed, as a result of a rapid pressure drop to create large numbers of uniform sites. Cell growth then takes place by means of diffusion of the gas to form bubbles. Control of the processing conditions provides the pressure and temperature changes necessary to control cell growth.

United States Patent Application Number 2001/0021726 in the name of James F Brown discloses porous surface compositions and methods of retaining biological samples on the surface. The method relies on the use of curable

polymers. United States Patent Number US 3794548 in the name of C Wirth et al discloses the use of polyurethane as a porous polymer film. Polymer is heated causing volatilisation of solvents within the polymer resulting in a porous coating. United States Patent Number US 6,228,476 in the name of Bogrett et al relates to a foam insulation sheet made using curable polymers.

PROBLEM TO BE SOLVED BY THE INVENTION

A problem with conventional methods of making foamed materials suitable for use as inkjet receivers is that the methods used to create polymer foams rely on high processing temperatures. This is undesirable as it is expensive in terms of energy requirements. Furthermore it is desirable to have a manufacturing process that does not require high temperatures, on grounds of safety.

A method of making a material is desired without the use of traditional foam manufacturing systems. A material is also required that can be made using methods that do not rely on traditional foam manufacturing systems.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a method of making a material comprising the steps of, coating a foamed solution of a gelatin or derivative thereof onto a support substrate and drying the coated substrate. The time period for the drying is selected to be short enough such that an open-cell foam is formed.

Preferably, the method comprises prior to the step of coating a foamed polymer solution of a gelatin or derivative thereof onto a support substrate, the step of, forming the foamed polymer solution of a gelatin or derivative thereof. For example, the foamed gelatin solution may be formed using a blowing agent.

Preferably, the coated substrate is dried using microwave radiation as a source of energy. Quick drying is preferred since the quicker the material is dried the less time there is for bubbles created in the polymeric solution to collapse.

Preferably, the step of drying the coated substrate lasts less than 8 minutes. More preferably, it lasts less than 5 minutes. Most preferably, it lasts less than 2 minutes.

ADVANTAGEOUS EFFECT OF THE INVENTION

The invention provides a method of making a material using a solution of hydrophilic polymer having bubbles created therein, and then coated onto a support substrate. In contrast to traditional polymer foams, which are manufactured using mostly hydrophobic thermoplastic materials such as Polyurethane, PVC and Polyethylene, lower processing temperatures can be used. Hydrophobic thermoplastic materials such as Polyurethane, PVC and Polyethylene require high processing temperatures since the polymers are in their molten state. Temperatures higher than 150°C are commonplace.

The present invention provides a simple and robust method for the manufacture of a material suitable for use as an inkjet receiver that does not require the use of high processing temperatures. This is more efficient in terms of cost and energy consumption and is also safer.

By ensuring that the time period of the drying step in the method of the present invention is short, an open-celled structure in the final product is created. This makes the material formed thereby particularly suitable for applications in which good absorption is required such as e.g. use as an ink jet receiver.

BRIEF DESCRIPTION OF THE DRAWINGS

Examples of the present invention will now be described in detail with reference to the accompanying drawing which shows a scanning electron micrograph of a section through a material made using the method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a scanning electron micrograph of a section through a material 2 according to one aspect of the present invention made using a method according to a further aspect of the present invention. The material comprises a

base 4 on which is arranged a foamed polymer layer 6. The foamed polymer layer has an open-celled arrangement made up of a number of interconnected cavities 8 within the layer 6. The layer 6 may comprise any gelatin or derivative thereof.

The invention provides a method of producing a foamed layer comprising of a network of voids within a gelatin matrix. The voids are created by the entrainment of gas into the polymer, which is coated and dried, giving rise to an open-cell arrangement of voids. The invention enables the creation of a foam film, e.g. using an aqueous gelatin solution, without the use of traditional foam manufacturing systems.

A gelatin layer with void spaces is produced by generating or introducing gas, into a coating solution. The layer is prepared by coating a layer of a foamed gelatin solution onto a substrate such as resin-coated paper. Micro-bubbles i.e. bubbles having a diameter from about 10μm to about 100μm are formed in the solution of gelatin. The micro-bubbles can be created either by air entrainment or with the use of a chemical or physical blowing agent.

Air entrainment involves the high-shear stirring of a gelatin solution to cause air to be entrained and form micro-bubbles. Use of a blowing agent involves the addition of the agent to a solution of the gelatin, followed by interaction with the solution to promote decomposition of the blowing agent. The interaction can involve the application of heat to promote the decomposition of the blowing agent to form a gas, and/or by the addition of a chemical reactant such as an acid to react with the blowing agent to again form micro-bubbles within the solution.

The coating solution may have added to it a surfactant to improve its suitability for use in coating. Examples of suitable surfactants include flouro-surfactants such as OLIN 10G.

The liquid composition containing the micro-bubbles is then coated onto a support. Any suitable coating method may be used. For example, any of bead coating, curtain, air knife coating or any other suitable coating method may be used. The coated layer is then dried to form the layer of open-celled foam. Typically, the drying may be achieved using microwave energy as a heat source. To ensure that an open-celled foam structure is formed it is preferable that the

drying is done immediately after application of the solution so that the opportunity for the voids within the foam to collapse is reduced.

Typically, a drying time of less than five minutes is used. If the drying is done in a microwave oven a drying time of less than three minutes may be possible and more preferably less than two minutes. Providing a short drying time ensures that the opportunity for the voids within the foam to collapse is reduced.

The time required to dry the coated substrate is also affected by the thickness of the coating on the substrate. For example a thicker coating will usually take longer to dry than a thinner coating of the same material. In all cases, the drying time is selected and controlled such that it is short enough so that the open-celled nature of the foam is maintained in the final product. In a material having coating thickness suitable for use in a typical inkjet receiver, a drying time of less than 2, 3 or 5 minutes is sufficient.

Example

The invention will be demonstrated by the example described below.

A solution of gelatin was coated onto a support consisting of a commercially available resin-coated paper. The coated layer was then dried creating a layer suitable for use as an ink-receiving layer if the material is to be used in inkjet printing.

The coating solution comprised an aqueous solution of gelatin mixed with a surfactant. The solution was whipped up using an electric high-shear stirrer at a speed of 15,000 rpm for 5 minutes. The ink-receiving layer consisted of 11.65 g/m^2 of gelatin and 2.408 g/m^2 of TX200E surfactant, which was coated using a gravure bar onto the support.

The coated substrate was then dried quickly, in this case using microwave radiation. The coated substrate was placed in a domestic microwave for 150 seconds on full power. The microwave used was a 700 Watt microwave, and an area of 0.0375 m^2 was coated. This provided power per area of approximately1.86 watts/cm^2.

The scanning electron micrograph shown in Figure 1 indicates that in the coating of the material according to the present invention, the foam mixture made by air entrainment has been coated and dried resulting in an open-celled foamed layer, where the pores within the layer are interconnected. Such a material is suitable for use in any application in which an absorbent material is required such as, amongst others, use as an inkjet receiver.

CLAIMS:

1. A method of making a material, the method comprising the steps of:
coating a foamed polymer solution of a gelatin or derivative thereof onto a support substrate; and,
drying said coated substrate, wherein the time period for said drying is selected to be short enough such that an open-cell foam is formed.

2. A method according to claim 1, in which the coated substrate is dried using microwave radiation as a source of energy.

3. A method according to claim 1, in which the step of drying said coated substrate lasts less than 8 minutes.

4. A method according to claim 3, in which the step of drying said coated substrate lasts less than 5 minutes.

5. A method according to claim 4, in which the step of drying said coated substrate lasts less than 2 minutes.

6. A method according to claim 1, comprising prior to the step of coating a foamed polymer solution of a gelatin or derivative thereof onto a support substrate, the step of, forming a foamed polymer solution of a gelatin or derivative thereof.

7. A method according to claim 6, wherein the step of forming the foamed polymer solution comprises high-shear stirring of a gelatin solution such that air is entrained in said gelatin forming bubbles therein.

8. A method according to claim 6, wherein the step of forming the foamed polymer solution comprises adding a physical or chemical blowing agent to a

solution of gelatin, and interacting with said blowing agent to cause it to decompose, thereby generating a gas.

9. A method according to claim 8, wherein the step of interacting with the blowing agent comprises heating the solution.

10. A method according to claim 8, wherein the step of interacting with the blowing agent comprises adding an acid to said solution to react with the blowing agent, thereby generating gas.

11. A material made using the steps of the method of any of claims 1 to 10.

12. An inkjet receiver comprising a material according to claim 11.

13. An inkjet receiver, comprising:
a support; and,
an ink receiving layer supported on said support, said ink receiving layer comprising porous gelatin, the ink receiving layer being formed using the steps of claim 1.

ABSTRACT

A FOAMED MATERIAL AND A METHOD OF MAKING THEREOF

The invention provides a method of making a material, the method comprising the steps of forming a foamed polymer solution of a gelatin or derivative thereof; coating the said solution onto a support substrate, and, drying the coated substrate. The time period for the drying is selected to be short enough such that an open-cell foam is formed. The invention also provides a material comprising a support; and, an ink receiving layer supported on said support. The ink receiving layer comprising porous gelatin, and is formed by coating a solution of foamed gelatin onto a support substrate, and, drying the coated substrate for a time period selected to be short enough such that an open-cell foam is formed.

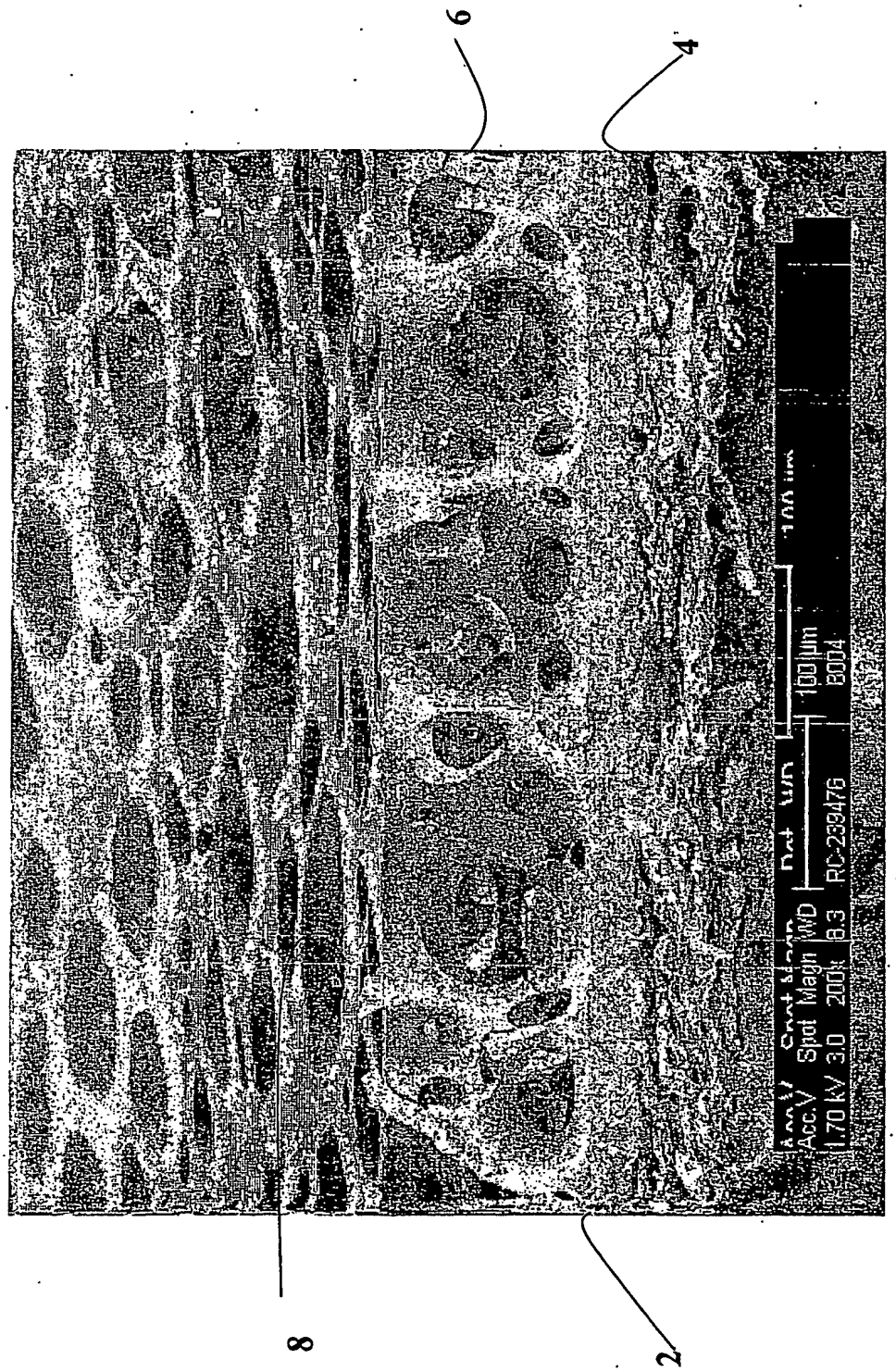

Fig. 1